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BY

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THE OTARIID SEALS OF THE PACIFIC COAST OF AMERICA

By JUDITH E. KING

FROM Alaska to Cape Horn along the Pacific coast of the Americas several species of Otariid seals have been recognized. These include both fur seals and hair seals which have been exploited by commercial sealers for over two centuries; but in spite of this there has always been some doubt about the exact identities of some of the animals concerned.

SPECIFIC IDENTITY OF *ARCTOCEPHALUS GALAPAGOENSIS* HELLER

1. *Heller's type specimen*

During 1898–99 the Hopkins Stanford Galapagos Expedition collected some seal skulls from Wenman Island in the Galapagos group. The skull of an adult male animal was described by Heller (1904) as the type of *Arctocephalus galapagoensis*. This skull is now in Stanford University, California, and although Heller gave its number as 2480, Mayer (1949) gives the correct number as 2812.

Measurements of two other skulls are given by Heller: No. 2481, male, nearly adult; occipital crests low; sutures indistinct. No. 2482, female, same as 2481 in age. Mayer (1949) gives the correct numbers of these as 4442 and 4446 respectively.

The specific characters of the skull are given by Heller as, " Distinguishable from its nearest ally *A. philippi* of Juan Fernandez by its wider skull, both the zygomatic and mastoid measurements being considerably greater, and by its longer snout and mandible."

Heller gives no indication of having compared this skull with that of any other seal except *A. philippi*. Photographs of the type skull of *A. galapagoensis* (Pls. 10A and C; 11A) have been compared with skulls of *A. philippi* and *A. australis*, the

two members of the genus *Arctocephalus* known to occur along the western coast of America. As Heller has stated, the skull of *A. galapagoensis* is markedly different from that of *A. philippi* but it differs not only in the characters he mentions but also in having a wider and less excavated palate, deep zygomatic arches and short broad nasals. These are just the characters in which skulls of *A. australis* differ so markedly from those of *A. philippi* and a comparison of the photographs of the skull of *A. galapagoensis* with skulls of *A. australis* shows a remarkable similarity (Pls. 10 and 11).

It should perhaps be mentioned that Heller does not indicate whether the total length of the animal from which the type skull was derived was taken from the tip of the snout to the tip of the tail or to the end of the longest digit of the hind flippers. An indication that the measurement was to the latter point is gained from dimensions which Turner (1888, *Rep. Sci. Res. H.M.S. "Challenger" Zool.* 26 : 39) gives of a specimen of an adult male *A. australis*. *They are as follows* :

From snout to tip of longest digit of pes : 5 ft. 10½ in. (1,790 mm.).

From snout to tip of tail in straight line : 4 ft. 11 in. (1,498·6 mm.).

Extreme condylo-premaxillary length of skull : 233 mm.

The greatest length of the type skull is 214 mm. and the total length of the animal is given by Heller as 1,675 mm. (5 ft. 6 in.). Thus by comparison with Turner's measurements, the *A. galapagoensis* type skull length is in proportion to body length if the latter is taken to the end of the hind flippers and not otherwise.

Measurements and proportions of the three Galapagos skulls have been compared with those of all the *A. australis* skulls in the British Museum collection (Table I). This includes 67 skulls from the Falkland Islands, four from the Straits of Magellan, one from Lobos Island, Uruguay, two from Messier Channel, Chile, and one from Tierra del Fuego. Graphs of the measurements of the various components of the skulls expressed as percentages of their condylo-basal lengths gave no indication of allometric growth. Length ratios plotted against the condylo-basal length showed no geographical differentiation, but width ratios showed that there was some difference between the skulls from the Falkland Islands and those from the "mainland" population, including the Galapagos Islands. Taking the zygomatic width as an example and using a graphical method the zygomatic width expressed as a percentage of the condylo-basal length in the Falkland sample has a mean value of 57·2%, a standard deviation of 2·5, and a standard error of the mean of 0·29. The corresponding figures for the mainland sample including those from the Galapagos, are 61, 3·2, and 0·96. The difference between these means is 3·8 and the standard error of the difference of the means is 1. The ratio $\frac{d}{\sigma d}$ is therefore 3·8. A difference of this magnitude would occur twice in 10,000 trials, but only once in 10,000 in the direction observed. This is statistically significant and indicates that the *A. australis* population on the Falkland Islands is slightly different from that inhabiting the South American coast and adjacent islands, but there are not enough skulls in the collection to see whether the individual mainland populations are in any way distinct from one another. The zygomatic width proportions of the Galapagos skulls are within the standard deviation of the mainland sample and slightly above that of the Falkland Islands sample.

TABLE I.—*Measurements and proportions of skulls of* A. australis
(See notes on measurements used)
FALKLAND ISLANDS

Registered No. and sex, if known	1949.3.17.1 Male		1949.3.17.2		1949.3.17.3		1949.3.17.4	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	248		247		248		243	
Condylo-basal length	241	100	239	100	246	100	239	100
Zygomatic breadth	155	64·3	143	59·8	138	56·1	146	61·1
Snout length	73	30·3	73	30·5	75	30·5	70	29·3
Snout width at canines	52	21·6	57	23·8	58	23·6	54	22·6
Snout width at level of 2nd cheek tooth	48	19·9	46	19·2	45	18·3	46	19·2
Anterior breadth nasals	34	14·1	32	13·4	35	14·2	29	12·1
Greatest length nasals	36	14·9	41	17·2	36	14·6	38	15·9
Least interorbital width*	32	13·3	35	14·6	29	11·8	29	12·1
Mastoid breadth	142	58·9	134	56·1	126	51·2	129	53·9
Length upper tooth-row i.—m. 6	92	38·2	88	36·8	96	39·0	89	37·2
Registered No. and sex, if known	1949.3.17.5		1949.3.17.6 Male		1949.3.17.7		1949.3.17.8	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	239		249		237		248	
Condylo-basal length	235	100	242	100	233	100	244	100
Zygomatic breadth	132	56·2	140	57·9	138	59·2	145	59·4
Snout length	73	31·1	73	30·2	72	30·9	74	30·3
Snout width at canines	54	22·1	54	22·3	55	23·6	59	24·2
Snout width at level of 2nd cheek tooth	45	19·1	45	18·6	46	19·7	51	20·9
Anterior breadth nasals	30	12·8	32	13·2	34	14·6	32	13·1
Greatest length nasals	32	13·6	35	14·5	40	17·2	40	16·4
Least interorbital width*	25	10·6	28	11·6	29	12·4	29	11·9
Mastoid breadth	126	53·6	137	56·6	129	55·4	134	54·9
Length upper tooth-row i.—m. 6	88	37·4	92	38·0	92	39·5	92	37·7
Registered No. and sex, if known	1949.3.17.9		1949.3.17.10		1949.3.17.11		1949.3.17.12	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	240		239		239		255	
Condylo-basal length	233	100	234	100	233	100	247	100
Zygomatic breadth	138	59·2	139	59·4	128	54·9	146	59·1
Snout length	72	30·9	70	29·9	68	29·2	76	30·8
Snout width at canines	50	21·5	48	20·5	51	21·9	57	23·1
Snout width at level of 2nd cheek tooth	41	17·6	41	17·5	44	18·9	49	19·8
Anterior breadth nasals	29	12·4	30	12·8	30	12·9	34	13·8
Greatest length nasals	38	16·3	38	16·2	35	15·0	38	15·4
Least interorbital width*	31	13·3	27	11·5	30	12·9	28	11·3
Mastoid breadth	129	55·4	126	53·8	128	54·9	137	55·5
Length upper tooth-row i.—m. 6	82	35·2	88	37·6	87	37·3	95	38·5

* Posterior to supraorbital processes.

FALKLAND ISLANDS—*continued*

Registered No. and sex, if known	1949.3.17.13		1949.3.17.14		1949.3.17.15		1949.3.17.17	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	232		239		231		235	
Condylo-basal length	225	100	233	100	225	100	226	100
Zygomatic breadth	134	59·6	135	57·9	144	64·0	124	54·9
Snout length	67	29·8	70	30·0	68	30·2	70	30·9
Snout width at canines	46	20·4	50	21·5	52	23·1	49	21·7
Snout width at level of 2nd cheek tooth	40	17·8	42	18·0	44	19·6	42	18·6
Anterior breadth nasals	28	12·4	29	12·4	31	13·8	28	12·4
Greatest length nasals	36	16·0	33	14·2	35	15·6	34	15·0
Least interorbital width*	30	13·3	30	12·9	29	12·9	25	11·1
Mastoid breadth	123	54·7	126	54·1	132	58·7	115	50·9
Length upper tooth-row i.—m. 6	85	37·8	87	37·3	88	39·1	88	38·9

Registered No. and sex, if known	1949.3.17.18		1949.3.17.19		1949.3.17.20		1949.3.17.21 Male	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	233		228		224		225	
Condylo-basal length	227	100	223	100	219	100	220	100
Zygomatic breadth	123	54·2	128	57·4	124	56·6	134	60·9
Snout length	67	29·5	65	29·1	64	29·2	66	30·0
Snout width at canines	46	20·3	50	22·4	45	20·5	50	22·7
Snout width at level of 2nd cheek tooth	37	16·3	41	18·4	38	17·4	42	19·1
Anterior breadth nasals	26	11·5	29	13·0	—	—	32	14·5
Greatest length nasals	35	15·4	33	14·8	—	—	33	15·0
Least interorbital width*	30	13·2	29	13·0	32	14·6	29	13·2
Mastoid breadth	113	49·8	121	54·3	114	52·1	125	56·8
Length upper tooth-row i.—m. 6	87	38·3	86	38·6	86	39·3	84	38·2

Registered No. and sex, if known	1949.3.17.22		1949.3.17.23		1949.3.17.24		1949.3.17.25	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	228		220		220		217	
Condylo-basal length	222	100	216	100	214	100	211	100
Zygomatic breadth	131	59·0	128	59·3	124	57·9	117	55·5
Snout length	69	31·1	64	29·6	65	30·4	60	28·4
Snout width at canines	47	21·2	44	20·4	46	21·5	42	19·9
Snout width at level of 2nd cheek tooth	42	18·9	36	16·7	39	18·2	37	17·5
Anterior breadth nasals	30	13·5	28	12·9	26	12·1	27	12·8
Greatest length nasals	36	16·2	36	16·7	33	15·4	37	17·5
Least interorbital width*	31	13·9	33	15·3	33	15·4	32	15·2
Mastoid breadth	117	52·7	115	53·2	117	54·7	108	51·2
Length upper tooth-row i.—m. 6	88	39·6	83	38·4	82	38·3	81	38·4

* Posterior to supraorbital processes.

FALKLAND ISLANDS—*continued*

Registered No. and sex, if known	1949.3.17.26		1949.3.17.27		1949.3.17.28		1949.3.17.29	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	213		214		215		219	
Condylo-basal length	209	100	210	100	210	100	214	100
Zygomatic breadth	118	56·5	117	55·7	114	54·3	127	59·3
Snout length	61	29·2	59	28·1	61	29·0	63	29·4
Snout width at canines	43	20·6	44	20·9	42	20·0	48	22·4
Snout width at level of 2nd cheek tooth	36	17·2	37	17·6	34	16·2	39	18·2
Anterior breadth nasals	27	12·9	28	13·3	24	11·4	29	13·6
Greatest length nasals	31	14·8	31	14·8	31	14·8	31	14·5
Least interorbital width*	31	14·8	28	13·3	27	12·9	34	15·9
Mastoid breadth	110	52·6	113	53·8	106	50·5	115	53·7
Length upper tooth-row i—m. 6	80	38·3	83	39·5	80	38·1	81	37·9

Registered No. and sex, if known	1949.3.17.30		1949.3.17.31		1949.3.17.32 Male		1949.3.17.33	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	222		218		214		215	
Condylo-basal length	218	100	212	100	212	100	209	100
Zygomatic breadth	122	55·9	115	54·2	116	54·7	115	55·0
Snout length	66	30·3	63	29·7	59	27·8	59	28·2
Snout width at canines	47	21·6	42	19·8	39	18·4	40	19·1
Snout width at level of 2nd cheek tooth	41	18·8	37	17·5	35	16·5	35	16·7
Anterior breadth nasals	29	13·3	28	13·2	26	12·3	24	11·5
Greatest length nasals	31	14·2	30	14·2	28	13·2	31	14·8
Least interorbital width*	29	13·3	35	16·5	26	12·3	29	13·9
Mastoid breadth	108	49·5	102	48·1	102	48·1	102	48·8
Length upper tooth-row i.—m. 6	85	38·9	84	39·6	83	39·2	—	—

Registered No. and sex, if known	1949.3.17.34		1949.3.17.35 Male		1949.3.17.36		1949.3.17.37 Male	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	213		205		197		197	
Condylo-basal length	209	100	203	100	191	100	193	100
Zygomatic breadth	119	56·9	108	53·2	104	54·5	107	55·4
Snout length	61	29·2	59	29·1	54	28·3	51	26·4
Snout width at canines	43	20·6	38	18·7	37	19·4	36	18·7
Snout width at level of 2nd cheek tooth	37	17·7	34	16·7	33	17·3	33	17·1
Anterior breadth nasals	25	11·9	24	11·8	23	12·0	23	11·9
Greatest length nasals	32	15·3	31	15·3	28	14·7	29	15·0
Least interorbital width*	27	12·9	30	14·8	31	16·2	35	18·1
Mastoid breadth	107	51·2	101	49·8	91	47·6	96	49·7
Length upper tooth-row i.—m. 6	81	38·8	78	38·4	76	39·8	71	36·8

* Posterior to supraorbital processes.

FALKLAND ISLANDS—*continued*

Registered No. and sex, if known	1949.3.17.38		1949.3.17.39		1949.3.17.40 Male		1949.3.17.41	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	184		190		187		180	
Condylo-basal length	181	100	187	100	184	100	177	100
Zygomatic breadth	98	54·1	102	54·5	100	54·3	101	57·1
Snout length	50	27·6	49	26·2	50	27·2	48	27·1
Snout width at canines	36	19·9	31	16·6	34	18·5	33	18·6
Snout width at level of 2nd cheek tooth	31	17·1	27	14·4	30	16·3	29	16·4
Anterior breadth nasals	23	12·7	22	11·8	23	12·5	22	12·4
Greatest length nasals	26	14·4	31	16·6	28	15·2	27	15·3
Least interorbital width*	34	18·8	28	14·9	35	19·0	37	20·9
Mastoid breadth	86	47·5	93	49·7	88	47·8	86	48·6
Length upper tooth-row i.—m. 6	71	39·2	70	37·4	72	39·1	70	39·5

Registered No. and sex, if known	1949.3.17.42 Male		1949.3.17.44		1949.4.17.46		1949.3.17.51	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	229		243		245		222	
Condylo-basal length	225	100	236	100	239	100	217	100
Zygomatic breadth	124	55·1	140	59·3	141	58·9	121	55·8
Snout length	65	28·9	71	30·1	72	30·1	63	29·0
Snout width at canines	46	20·4	52	22·0	51	21·3	44	20·3
Snout width at level of 2nd cheek tooth	38	16·9	44	18·6	45	18·8	38	17·5
Anterior breadth nasals	28	12·4	33	13·9	35	14·6	27	12·4
Greatest length nasals	34	15·1	36	15·3	38	15·9	34	15·7
Least interorbital width*	24	10·7	23	9·7	30	12·6	26	11·9
Mastoid breadth	116	51·6	126	53·4	136	56·9	109	50·2
Length upper tooth-row i.—m. 6	87	38·7	86	36·4	91	38·1	84	38·7

Registered No. and sex, if known	1949.3.17.53		1949.3.17.57		1949.3.17.58		1949.3.17.59	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	192		175		223		169	
Condylo-basal length	188	100	172	100	220	100	167	100
Zygomatic breadth	104	55·3	102	59·3	118	53·6	96	57·5
Snout length	54	28·7	49	28·5	65	29·5	45	26·9
Snout width at canines	36	19·1	37	21·5	42	19·1	29	17·4
Snout width at level of 2nd cheek tooth	34	18·1	31	18·0	36	16·4	28	16·8
Anterior breadth nasals	24	12·8	—	—	30	13·6	22	13·2
Greatest length nasals	28	14·9	27	15·7	32	14·5	25	14·9
Least interorbital width*	35	18·6	35	20·3	32	14·5	—	—
Mastoid breadth	94	50·0	87	50·6	112	50·9	84	50·3
Length upper tooth-row i.—m. 6	73	38·8	66	38·4	89	40·5	66	39·5

* Posterior to supraorbital processes.

FALKLAND ISLANDS—*continued*

Registered No. and sex, if known	1949.3.17.60		1949.3.17.62		1949.3.17.63		1949.3.17.64	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	208		220		213		167	
Condylo-basal length	204	100	216	100	209	100	164	100
Zygomatic breadth	114	55·9	123	56·9	120	57·4	94	57·3
Snout length	56	27·5	65	30·1	60	28·7	43	26·2
Snout width at canines	40	19·6	46	21·3	45	21·5	29	17·7
Snout width at level of 2nd cheek tooth	34	16·7	39	18·1	40	19·1	27	16·5
Anterior breadth nasals	25	12·3	28	12·9	27	12·9	17	10·4
Greatest length nasals	27	13·2	36	16·7	33	15·8	24	14·6
Least interorbital width*	34	16·7	33	15·3	36	17·2	32	19·5
Mastoid breadth	102	50·0	112	51·9	107	51·2	85	51·8
Length upper tooth-row i.—m. 6	82	40·2	86	39·8	82	39·2	64	39·2

Registered No. and sex, if known	1949.3.17.65		1949.3.17.66		1949.3.17.67		1949.3.17.68	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	231		188		180		236	
Condylo-basal length	226	100	184	100	177	100	230	100
Zygomatic breadth	119	52·7	97	52·7	101	57·1	136	59·1
Snout length	66	29·2	47	25·5	47	26·6	72	31·3
Snout width at canines	43	19·0	34	18·5	31	17·5	52	22·6
Snout width at level of 2nd cheek tooth	36	15·9	27	14·7	28	15·8	42	18·3
Anterior breadth nasals	—	—	23	12·5	—	—	—	—
Greatest length nasals	35	15·5	25	13·6	—	—	—	—
Least interorbital width*	29	12·8	37	20·1	30	16·9	28	12·2
Mastoid breadth	107	47·3	85	46·2	92	51·9	119	51·7
Length upper tooth-row i.—m. 6	89	39·4	70	38·0	66	37·3	90	39·1

Registered No. and sex, if known	1949.3.17.69		1949.3.17.71		1949.3.17.72		1949.3.17.73	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	221		210		211		214	
Condylo-basal length	215	100	206	100	206	100	213	100
Zygomatic breadth	114	53·0	117	56·8	115	55·8	119	55·9
Snout length	65	30·2	59	28·6	60	29·1	64	30·0
Snout width at canines	48	22·3	41	19·9	40	19·4	45	21·1
Snout width at level of 2nd cheek tooth	39	18·1	35	16·9	33	16·0	37	17·4
Anterior breadth nasals	24	11·2	22	10·7	26	12·6	—	—
Greatest length nasals	29	13·5	31	15·0	33	16·0	31	14·6
Least interorbital width*	25	11·6	29	14·1	28	13·6	26	12·2
Mastoid breadth	—	—	103	50·0	107	51·9	112	52·6
Length upper tooth-row i.—m. 6	83	38·6	77	37·4	77	37·4	86	40·4

* Posterior to supraorbital processes.

FALKLAND ISLANDS—*continued*

Registered No. and sex, if known	1949.3.17.75		1949.3.17.80		1949.3.17.81		1950.11.14.1 ? Male	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	216		217		197		225	
Condylo-basal length	212	100	213	100	194	100	218	100
Zygomatic breadth	115	54·2	118	55·4	109	56·2	132	60·6
Snout length	62	29·2	61	28·6	54	27·8	67	30·7
Snout width at canines	40	18·9	43	20·2	36	18·6	49	22·5
Snout width at level of 2nd cheek tooth	35	16·5	36	16·9	30	15·5	41	18·8
Anterior breadth nasals	—	—	26	12·2	25	12·9	31	14·2
Greatest length nasals	—	—	33	15·5	27	13·9	38	17·4
Least interorbital width*	38	17·9	29	13·6	27	13·9	25	11·5
Mastoid breadth	108	50·9	107	50·2	101	52·1	125	57·3
Length upper tooth-row i.—m. 6	82	38·7	85	39·9	76	39·2	81	37·2

Registered No. and sex, if known	1950.11.14.2		1855.12.26.167		1013*e*	
	mm.	%	mm.	%	mm.	%
Greatest length	219		239		143	
Condylo-basal length	213	100	235	100	141	100
Zygomatic breadth	122	57·3	145	61·7	80	56·7
Snout length	64	30·0	71	30·2	38	26·9
Snout width at canines	44	20·7	57	24·3	29	20·6
Snout width at level of 2nd cheek tooth	38	17·8	48	20·4	27	19·1
Anterior breadth nasals	28	31·1	30	12·8	18	12·8
Greatest length nasals	31	14·6	40	17·0	21	14·9
Least interorbital width*	28	13·1	32	13·6	32	24·1
Mastoid breadth	—	—	135	57·4	73	51·8
Length upper tooth-row i.—m. 6	5 teeth	—	88	37·4	57	40·4

	MESSIER CHANNEL, CHILE				STRAITS OF MAGELLAN			
Registered No. and sex, if known	1950.11.14.4 Male		1950.11.14.3 Female		1879.8.21.5 Male		1880.7.28.12	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	230		201		205		226	
Condylo-basal length	225	100	196	100	201	100	220	100
Zygomatic breadth	132	58·7	116	59·2	112	55·7	135	61·4
Snout length	66	29·3	60	30·6	56	27·9	66	30·0
Snout width at canines	55	24·4	36	18·4	35	17·4	50	22·7
Snout width at level of 2nd cheek tooth	46	20·4	35	17·9	32	15·9	41	18·6
Anterior breadth nasals	31	13·	26	13·3	22	10·9	—	—
Greatest length nasals	35	15·6	30	15·3	29	14·4	—	—
Least interorbital width*	32	14·2	26	13·3	27	13·4	—	—
Mastoid breadth	128	56·9	106	54·1	100	49·8	124	56·4
Length upper tooth-row i.—m. 6	87	38·7	80	40·8	79	39·3	85	38·6

* Posterior to supraorbital processes.

Registered No. and sex, if known	STRAITS OF MAGELLAN—*continued* 1880.7.28.7		1919.7.7. 10090		LOBOS ISLANDS, URUGUAY 1947.7.16.4 Female		TIERRA DEL FUEGO 1880.7.28.17	
	mm.	%	mm.	%	mm.	%	mm.	%
Greatest length	226		128		210		131	
Condylo-basal length	223	100	126	100	207	100	129	100
Zygomatic breadth	146	65·5	80	63·5	131	63·3	74	57·4
Snout length	70	31·4	34	26·9	64	30·9	36	27·9
Snout width at canines	53	23·8	26	20·6	48	23·2	28	21·7
Snout width at level of 2nd cheek tooth	46	20·6	25	19·8	42	20·3	26	20·2
Anterior breadth nasals	31	13·9	17	13·5	32	15·5	17	13·2
Greatest length nasals	33	14·8	18	14·3	32	15·5	20	15·5
Least interorbital width*	34	15·2	36	28·6	31	14·9	35	27·1
Mastoid breadth	125	56·1	66	52·4	113	54·6	67	51·9
Length upper tooth-row i.—m. 6	87	39·0	62	49·2	82	39·6	54	41·9

Registered No. and sex, if known	GALAPAGOS ISLANDS 2812 Type male		2481 Female		2482 Female	
	mm.	%	mm.	%	mm.	%
Greatest length	214		203		200	
Condylo-basal length	211	100	200	100	197	100
Zygomatic breadth	134	63·5	124	62·0	120	60·9
Snout length	62	29·4	—	—	—	—
Snout width at canines	54	25·7	—	—	—	—
Snout width at level of 2nd cheek tooth	42	19·9	—	—	—	—
Anterior breadth nasals	27·5	13·0	22	11·0	22	11·2
Greatest length nasals	38	18·0	—	—	—	—
Least interorbital width*	25	11·8	28	14·0	27	13·7
Mastoid breadth	126	59·7	—	—	—	—
Length upper tooth-row i.—m. 6	86	40·8	80	40·0	75	38·1

* Posterior to supraorbital processes.

The length measurements show that the mainland skulls tend to be rather smaller than Falkland skulls of approximately the same age. Photographs of the Galapagos skull show that it is considerably more adult in appearance than its small size would suggest. Skulls of similar condylo-basal length from the Falkland Islands are obviously from young animals (Pl. 11). They have no sagittal crest, practically no occipital crest and the zygomatic arch has not yet attained the great depth that it does in the old animal. Heller describes the Galapagos type skull as " old adult ; sutures largely obsolete ; occipital and parietal crests high," and the photographs show these characters of age, as well as the deep zygomatic arch.

The fact that there is tending to be a smaller mainland race of *A. australis* and a larger Falkland Island race is interesting in the light of a recent paper by Sivertsen (1953) on a new species *Zalophus wollebaeki* from the Galapagos Islands. Measurements of 20 skulls of this new species were compared with those of 21 *Zalophus* skulls from California. The mean condylo-basal length of the Galapagos skulls was 264 mm., with a maximum of 276 mm., while the corresponding figures for the Californian skulls were 292 mm. and 323 mm. The type of *Z. wollebaeki*, an old male, had a condylo-basal length of 267 mm., with a high sagittal crest and very worn teeth, while the only Californian skull of a similar age had a condylo-basal length of 323 mm.

Thus while there can be no doubt that the fur seal on the Galapagos Islands is *A. australis*, the comparative measurements given here (Table I) make it seem probable that there is a race of smaller animals living on the islands. There is not at the moment sufficient material in the collection to be able to distinguish the Galapagos population from other communities living on or close to the mainland of South America, and it is for this reason that subspecific rank cannot be given to the Galapagos fur seals. The type locality for *A. australis* Zimmermann is the Falkland Islands, so that if this population is considered subspecifically distinct from that on the mainland, the name should be *A. australis australis*. Since the individual populations on the mainland cannot be separated subspecifically, the first available name for the whole is *A. australis gracilis* Nehring 1887, and should the Galapagos population eventually prove to be distinct *A. australis galapagoensis* is available. As the main purpose of the present paper does not principally concern the genus *Zalophus*, and pending the publication of Sivertsen's more comprehensive paper on the *Otariidae*, *Z. wollebaeki* may be regarded as bearing the same relation to *Z. californianus* that the Galapagos *Arctocephalus* bears to *A. australis*.

2. *Townsend's specimens*

During 1932 and 1933 several living fur seals were captured at the Galapagos Islands and sent to the San Diego Zoological Gardens. Three of these animals (an adult male, an adult female and a juvenile) died, and their skins and skulls form the subject of a paper by Townsend (1934) who referred them to *Arctocephalus galapagoensis* Heller. As Heller's desciption of the type of this species, particularly of the skull is not very detailed, and he published no photograph or drawing of the skull, Townsend seems to have based his identification mainly on the locality. He says that he compared his skulls with those of *Arctocephalus* collected " in the Straits of Magellan and on the beaches at the Galapagos and from Guadalupe," but gives no details of this comparison. A few measurements of the *Arctocephalus* from the Straits of Magellan are inserted in a list of measurements of the male skull from the Galapagos, but no reference is made to these in the text.

As the animals described by Townsend are fur seals of the genus *Arctocephalus* the photograph of the skull of one of them has been compared with those of A. *australis* and *A. philippi*, the only fur seals known to occur off the coast of South America. It is at once obvious from the general similarity, and in particular from

the broad snout, wide palate, short nasals and deep zygomatics that the animals received by Townsend from the Galapagos are Southern fur seals, *Arctocephalus australis*.

Townsend gives the length of the male carcase as 4 ft. 6 in. from the tip of the nose to the tip of the tail, and the greatest basal length of the skull as 212 mm.

Townsend's measurements of the male skull are given together with those of a skull of *A. australis* (1880.7.28.7) in the British Museum collection (Table II). It is evident from the table that there is a close similarity between the two skulls. The two measurements that show most divergence are those involving interorbital width. With regard to these it may be said that the British Museum collection includes specimens of length comparable to that of Townsend's with smaller interorbital width, and the variability of this part of the skull is striking.

TABLE II.

(See notes on measurements used)

	Measurements of male skull given by Townsend		*A. australis* 1880.7.28.7	
		%		%
Greatest length	212		226	
Condylo-basal length	208*	100	223	100
Basal length (gnathion-basion)	202	97·1	214	95·9
Basilar length (basion-henselion)	198	95·2	209	93·7
Palatal length (gnathion-palation)	99	47·6	103	46·2
Zygomatic breadth	132	63·5	146	65·5
Canine to last upper molar (inclusive)	68	32·7	70	31·4
Distance between upper canines (internally)	26	12·5	25	11·2
Distance between 3rd upper molars (internally)	27	12·9	33	14·8
Interorbital width (anterior to supraorbital process)	27	12·9	40	17·9
Interorbital width (posterior to supraorbital process)	26·5	12·7	34	15·2
Width of supraorbital processes	46	22·1	58 est.	26·0
Greatest length nasals	29	13·9	33	14·8
Ant. breadth nasals	25·5	12·3	31	13·9
Breadth rostrum at 2nd molar	44	21·2	46	20·6
Mastoid breadth	117	56·3	125	56·1

* Condylo-basal length estimated as it is not given by Townsend.

SPECIFIC IDENTITY OF *ARCTOCEPHALUS TOWNSENDI* MERRIAM

The other fur seal of the genus *Arctocephalus* from the American coast, *A. philippi*, was described in 1866 by Peters from the skull of an adult (but not old) male animal collected on Juan Fernandez in December, 1864, by Dr. Philippi. Full size drawings

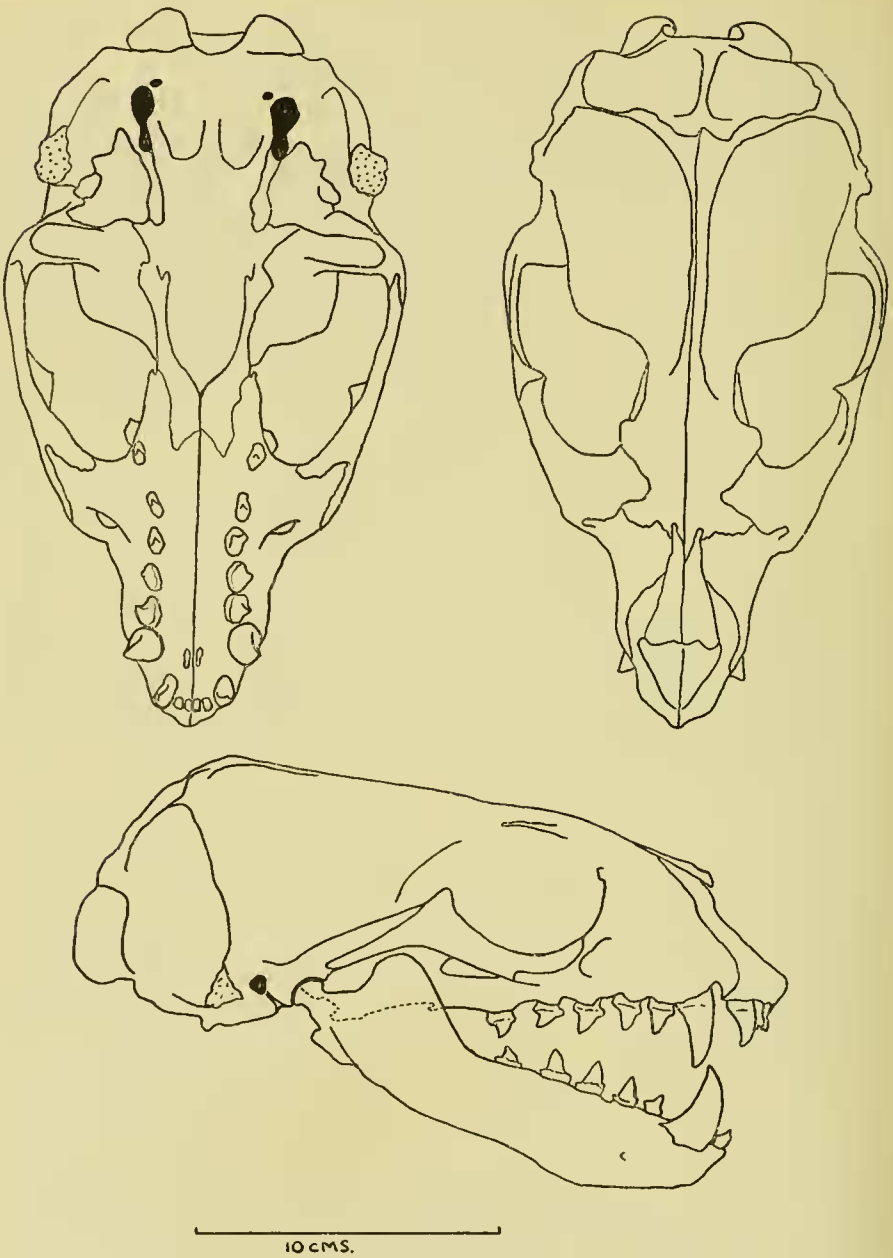


FIG. 1. Type skull of *Arctocephalus philippi* from Peters, *Monatsb. Akad. Berlin*, 1866, pl. 11.

of the skull were given (Fig. 1) from which measurements have been taken for comparison. The most important skull characters for distinguishing the species are given by Peters as follows :

1. The palate is deep in front and shallow behind, and is twice as broad between the last molars as between the canines.
2. The posterior ends of the maxillae are prolonged into small hooks.[1]
3. The maxillary root of the zygomatic arch is very broad antero-posteriorly.
4. The tympanic bullae are flat.
5. The mastoid process is long, but does not jut out ventrally.
6. The zygomatic arch is narrow.
7. The lower jaw has no pronounced angle ; the coronoids are rounded and project backwards.
8. The peculiar pointed form and the lack or weak development of accessory cusps on the molar teeth, which are separated from each other by relatively large spaces.

All these characters are visible both in Peters' drawings of the type skull and in a skull of this species from Juan Fernandez in the British Museum collection (Reg. No. 1883.11.8.1.).

A. philippi, the type locality of which is Juan Fernandez, is a fur seal, as is evident from Peters' description of the long overfur and the thick underfur. The only other animal with which it may be confused is the Southern fur seal, *A. australis*, which ranges from Uruquay, round the Straits of Magellan and along the west coast of South America. Externally *A. philippi* may be distinguished from *A. australis* chiefly by its long tapering snout which is very unlike the short, rather upturned snout of *A. australis*. When seen side by side skulls of the two species show many differences. The skull of *A. philippi* (Fig. 1) is more finely built than that of *A. australis* (Fig. 2). In general shape it is long and slender, as are also the nasal bones ; and the zygomatic arches are narrow in lateral view. The palate is also narrow and is very concave between molars 1–3. The skull of *A. australis* is much more robust, the nasals are short and broad, the palate is not particularly narrow or concave and the zygomatic arches are strong and deep. These differences can easily be seen in the drawings of the two skulls (Figs. 1 and 2).

In 1870 the Museum at Santiago was presented with a male, a female and a young seal from the island of Masafuera. These were considered to be a new species and formed the subject of a paper in 1871 in which they were called *Otaria argentata* (Philippi in Peters, 1871). Philippi gives a drawing of the skull of this new species and a list of characters in which it differs from *A. philippi*. The skin of *O. argentata* is said to differ chiefly by its lighter colour and by the guard hairs of the neck being shorter than those of *A. philippi*. The measurements given of the stuffed male show it to be a young animal as it is only 3 ft. 9 in. from nose to tail, and Philippi himself says that the skull is not fully grown as the crests are not developed. The length of the neck hairs and many of the characters of the skull used by Philippi to distinguish the species may be explained by the youth of the specimen, and the drawing

[1] Not confined to this species

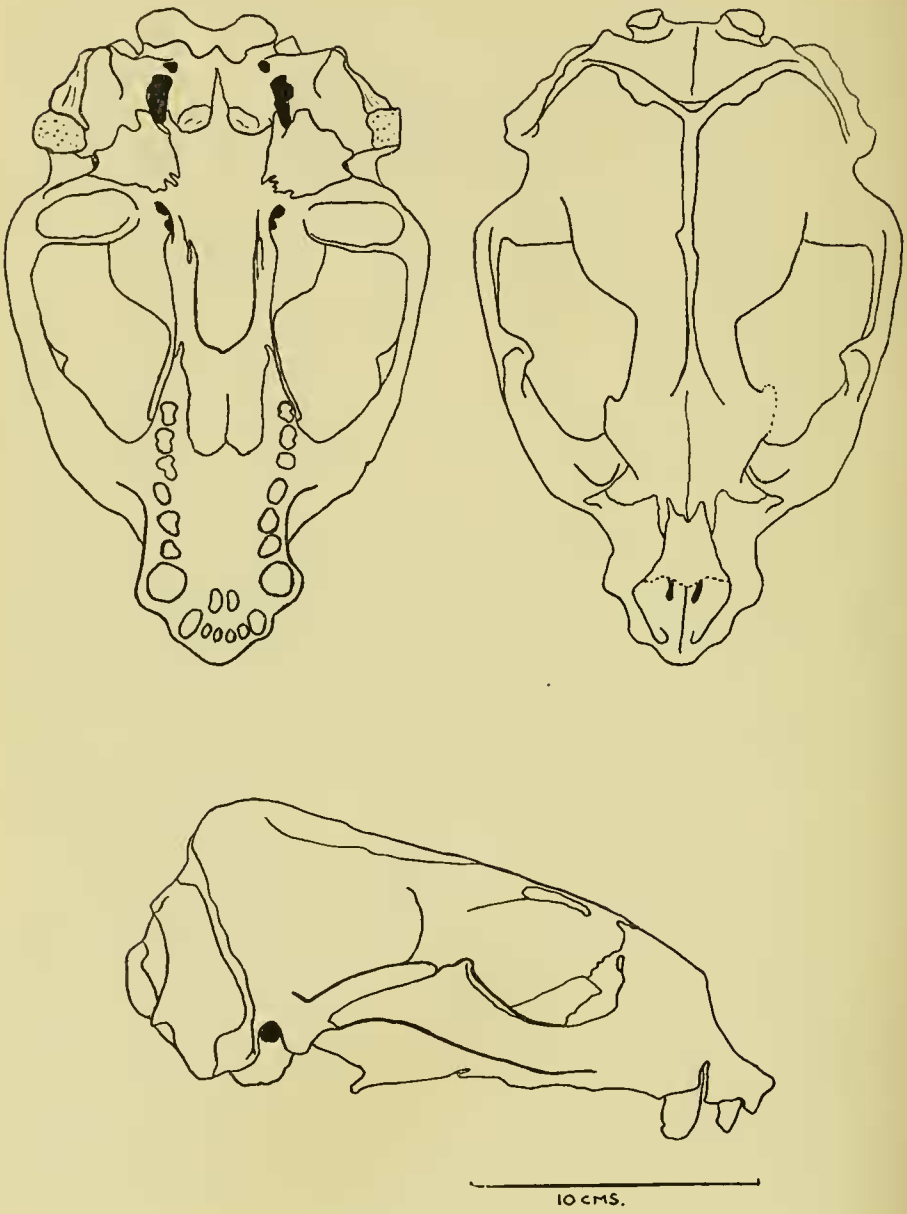


FIG. 2. Orthographic projection of skull of *Arctocephalus australis*, 1880.7.28.7.

of the skull gives proof that the animal is another specimen of *A. philippi*. Peters, in his discussion of Philippi's letter, says that if it had not been for Philippi's insistence that *O. argentata* and *A. philippi* were different, he " would have thought twice about describing them as two different species."

In 1892 an expedition sailed from San Diego to Guadalupe for the purpose of identifying the fur seals present on the island. Seven seals were seen and one was shot, but sank. Four skulls were picked up on the beach and one of these forms the type of a new species *Arctocephalus townsendi* which was described by Merriam in 1897. The skull is that of an adult male No. 83617 U. S. National Museum. Merriam compares this type " with skulls of *Arctocephalus* (*australis* or *philippi*) from the Galapagos Islands," and from the characters that he gives it is evident that he compared his skull with *A. australis* and had not seen a skull of *A. philippi*.

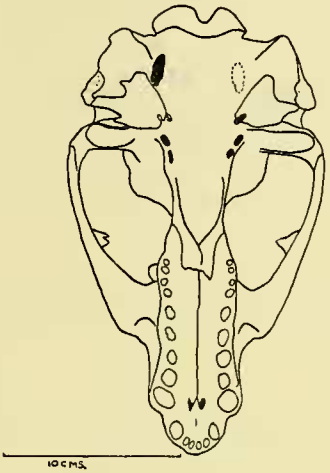


FIG. 3. Type skull of *Arctocephalus townsendi*, U.S. Mus. No. 83,617. Taken from Allen, 1905, Patag. Exp. III ; pl. xviii.

Merriam lists the most important characters for identifying the skull of *A. townsendi* as follows :

1. The exceedingly narrow and excavated palate.
2. Flat tympanic bullae.
3. Short and thick ascending arm of premaxilla.
4. Broadly expanded zygomatic root of maxilla, forming a floor under the anterior half of the orbit.
5. The 5th molar mainly posterior to the plane of the anterior root of the zygoma.

When these characters are compared with those given by Peters for the type skull of *A. philippi* it will be seen that Merriam's Nos. 1, 2 and 4—important diagnostic features—correspond exactly with Nos. 1, 4 and 3 respectively of Peters' description. Merriam's character No. 3 is not visible in the ventral view of the skull which he gives. His fifth character, while it is good for the specimen of *A. philippi* in the British Museum collection, is not distinctive.

When a further comparison is made between the measurements and proportions of the type skull of *A. philippi*, the skull of this species in the British Museum, and the type skull of *A. townsendi* (Table III) it will be seen that these three skulls are so similar that it is probable that they all belong to the same species of *Arctocephalus*. Comparison of the drawings (Figs. 1 and 3) of these skulls also confirms this view, and it is thus possible to add *Arctocephalus townsendi* Merriam to the synonymy of *Arctocephalus philippi* Peters.

Allen (1905) described skulls from the Galapagos which he called *A. philippi*, and combined a very " free translation " of the characters given by Peters with some which are obviously only from the skulls he was describing. His figured skulls show the typical high sagittal crest of the male *Zalophus* and it is clear that he has mistakenly identified these skulls as *A. philippi*. Osgood (1943) says that Remington Kellogg and G. M. Miller examined Allen's skulls from the Galapagos and found that they were undoubtedly *Zalophus californianus*.

Table III.

(See notes on measurements used)

	A. townsendi type		*A. philippi* type		*A. philippi* 1883.11.8.1	
	mm.	%	mm.	%	mm.	%
Greatest length	256		236		255	
Condylo-basal length	*252	100	233	100	248	100
Zygomatic breadth	151	59·9	129	55·4	139	56·0
Snout length	†69	27·4	63	27·0	73	29·4
Snout width at canines	†53	21·0	45	19·3	45	18·1
Canine to last upper molar (inclusive)	88	34·9	‡75	32·2	91	36·7
Distance between 3rd upper molars (internally)	22·5	8·9	21	9·0	19	7·7
Antero-posterior width of zygomatic root of the maxilla	21	8·3	20	8·6	22	8·9
Interorbital width (posterior to supra-orbital process)	†30	11·9	30	12·9	31	12·5
Mastoid breadth	†133	52·8	115	49·4	125	50·4
Greatest length nasals	—	—	41	17·6	45	18·1
Anterior breadth nasals	—	—	26	11·2	25	10·1

* Estimated.

† Measurements taken from 1/1 drawing of type skull in Allen (1905). Other measurements as given by Merriam (1897).

‡ Peters' type has only 5 upper molars. Measurements of skull taken from 1/1 drawing in Peters (1866).

DISTRIBUTION AND PARTIAL RECORDS OF *A. PHILIPPI* ON THE PACIFIC COAST OF AMERICA

The records of the occurrence of *A. philippi* which are listed below are based partly on the identification of actual specimens, and partly on records of " fur seals " from the Californian Islands which are, according to Starks (1922) *A. townsendi* = *A. philippi.*

1. *Juan Fernandez*

(*a*) 1864. Type specimen killed (Peters, 1866).
(*b*) — " Some years ago," possibly in 1864, a few dozen skins taken by Philippi (Philippi in Peters, 1871).
(*c*) 1883. Skull of specimen in British Museum collection. Presented by Chilean Government.
(*d*) — Skull in Santiago Museum. No locality given (Philippi in Peters, 1871).

2. *Masafuera*

(*a*) 1870. 3 seals collected. One of these described as type of *O. argentata* (Philippi in Peters, 1871).

3. *Chonos Islands*

(*a*) 1871. A skin taken by Philippi's assistant (Philippi in Peters, 1871).

4. *San Benito Islands*

(*a*) 1806. 8,338 skins taken by the " Port au Prince " (Townsend, 1924, 1931).

5. *Guadalupe*

(*a*) 1878. A few hundred skins taken from Guadalupe and Santa Barbara (Starks, 1922).
(*b*) 1880. Fur seals tightly packed (Merriam 1897).
(*c*) 1883. 2,000 killed, but commercially extinct (Merriam, 1897).
(*d*) 1891. Only a few seen (Merriam, 1897).
(*e*) 1892. 7 seals seen and 4 skulls obtained from which type of *A. townsendi* described (Merriam, 1897).
(*f*) 1922. None seen (Anthony, 1925).
(*g*) 1922. 2 year old female sent to San Diego Zoo (Starks, 1922).
(*h*) 1928. 2 males caught and sent to San Diego Zoo, and 60 seals estimated to be on the island (Townsend, 1931).
(*i*) 1929 . Some fur seals seen in May (Townsend, 1930).
(*j*) 1950. None seen (Bartholomew and Hubbs, 1952).

6. *Santa Barbara Islands*

(*a*) 1878. A few hundred skins taken from Guadalupe and Santa Barbara (Starks, 1922).
(*b*) 1890. 5 seals taken off San Miguel (Starks, 1922).
(*c*) 1901. 3 seals killed on Santa Cruz (Starks, 1922).
(*d*) 1949. Single adult male seen (Bartholomew and Hubbs, 1952).

7. *Ventura, California*

(*a*) Eighteenth to nineteenth centuries. Abundant remains found in shell mound (Lyon, 1937).

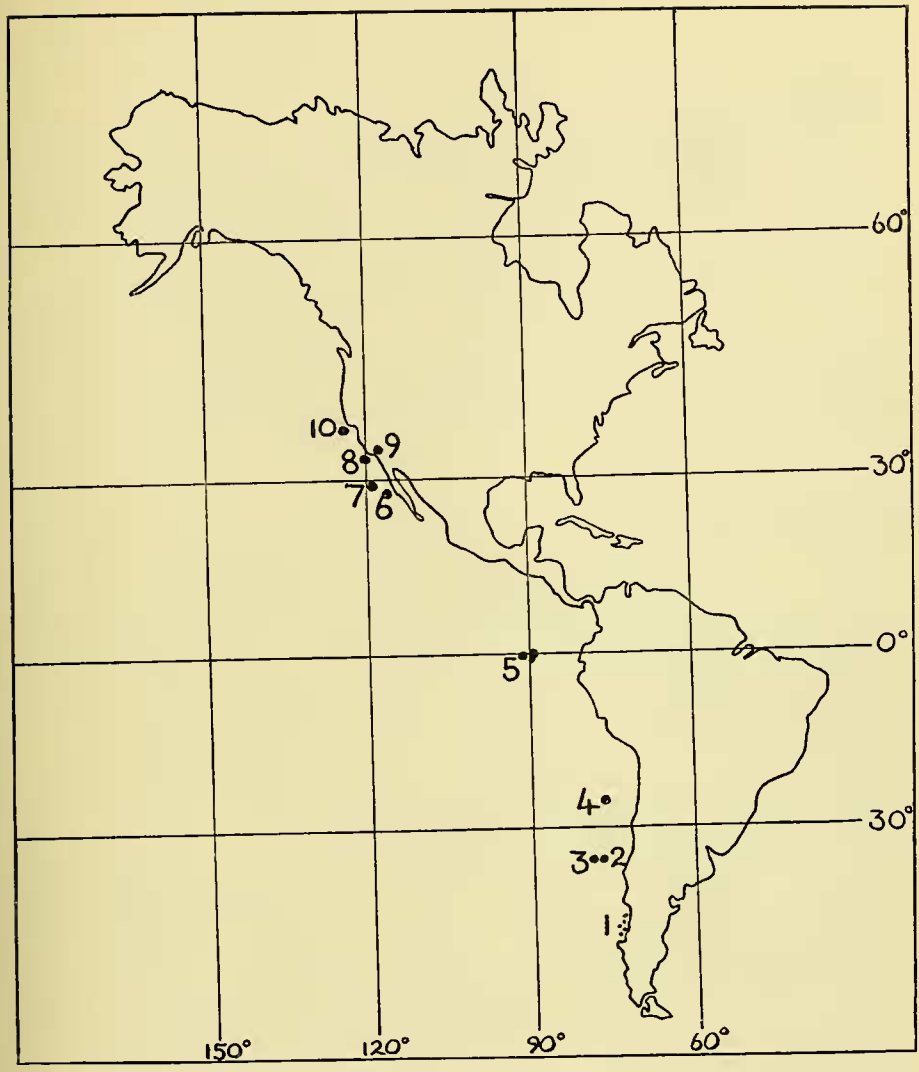
8. *Farallone Islands*

(*a*) 1810–1812. 73,402 skins taken by Americans (Starks, 1922).
(*b*) 1812–1840. Russians took 1,200–1,500 skins annually (Starks, 1922).
(*c*) 1818. Seals diminishing rapidly (Starks, 1922).
(*d*) 1824. Seals profitable again, over 1,000 skins taken, but decreased to 54 skins in 2 years (Starks, 1922).

The first record of a relatively recent occurrence of the fur seal is the finding of skull remains from the eighteenth to nineteenth centuries in a shell mound at Point Mugu, Ventura County, California, 1,557 identifiable bones of this seal were found and it was by far the most abundant animal in the collection. No more records are available until 1806 when over 8,000 skins were taken from the San Benito Islands. The seal was abundant on all the islands off the Californian coast and was taken for its fur in great numbers until about 1883 when it was considered extinct commercially. From that time until the present day there have been only a few sporadic noted occurrences, the last being an adult male seen on San Nicolas Island in 1949.

As there are so few records of *A. philippi* being seen on Juan Fernandez and Masafuera it seems probable that the normal habitat of this seal is the islands off the Californian coast. When it is known to have been so plentiful in the northern part of its range it is noteworthy that there have been so few records of its occurrence on Juan Fernandez, although this may be attributed partly to the remoteness of this island compared with those off the Californian coast. It is probable that Juan Fernandez represents the most southerly extent of its distribution and that there has never at any time been a great number of *A. philippi* on the island. The presence of a small number of *A. philippi* would be masked by the large numbers of *A. australis* which undoubtedly occurred on the island, and the differences would not be noticed by the sealers who would class them all as " fur seals." It was only scientifically interested people like Dr. Philippi who collected the type which was named after him, and the chemist Fr. Leyboldt who collected the type of *O. argentata* who noticed the difference between the two species.

The present state of *A. philippi* is unknown. It may be extinct, but since an adult male has been seen as recently as 1949 it seems possible that there may still be a small colony left.



Map to show seal-inhabited islands off the Pacific American coast.

1. Chonos Islands.
2. Juan Fernandez.
3. Masafuera.
4. St. Felix, St. Ambrose, St. Mary's Islands.
5. Galapagos Islands.
6. San Benito Islands.
7. Guadalupe.
8. Santa Barbara Islands.
   San Nicolas.
   Santa Cruz.
   Santa Rosa.
   San Miguel.
9. Ventura.
10. Farallone Islands.

PARTIAL RECORDS OF "FUR SEALS" OFF THE COAST OF SOUTH AMERICA

1. *Masafuera*

(*a*) 1563. Island discovered. Swarming with fur seals (Allen, 1899).
(*b*) 1792. Capt. Stewart of the "Eliza" took 38,000 skins to Canton and sold them for 16,000 dollars (Allen, 1899).
(*c*) 1797. Americans came about this time. 2–3 million seals on island. 3 million taken to Canton in 7 years. People from 14 ships on island at the same time, all killing seals (Allen, 1899).
(*d*) 1798. Capt. Fanning of the "Betsy" took 100,000 skins to Canton and estimated that when he left there were still 500,000–700,000 seals on the island (Allen, 1899).
(*e*) 1807. Capt. Morrell—business scarcely worth following (Allen, 1899).
(*f*) 1824. Capt. Morrell—island almost entirely abandoned by seals (Allen, 1899).
(*g*) 1891. Capt. Gaffney saw 300–400 and took 19 (Allen 1899).

2. *Juan Fernandez*

(*a*) 1683. Dampier—seals thick about the island (Allen, 1899).
(*b*) 1687–90. Capt. Davies of the "Bachelors Delight" left some men on the island to cure seal-skins (Albes, 1914).
(*c*) 1741. Anson—many seals and sea-lions (elephant seals) (Anson, 1744).
(*d*) 1800. Capt. Delano—human population of 3,000 on island, so no seals left (Allen, 1899).
(*e*) 1891. Capt. Gaffney saw a few fur seals in December (Allen, 1899).
(*f*) 1931. Nybelin got a parasite from an *A. australis* (Nybelin, 1931).

3. *St. Felix, St. Ambrose, St. Mary's Islands*

(*a*) 1792. 13,000 skins taken during August and September by American ship "Jefferson" (Howay, 1930).
(*b*) 1801. Islands were visited by sealers and there must have been large numbers of seals (Allen, 1899).
(*c*) 1816. Capt. Fanning took 14,000 skins at St. Mary's (Allen, 1899).
(*d*) 1891. No seals worth mentioning (Allen, 1899).

4. *Galapagos Islands*

(*a*) 1535. Seals mentioned by discoverer of Galapagos (Baur, 1897).
(*b*) 1800. Large numbers of fur and hair seals (Allen, 1899).
(*c*) 1816. Capt. Fanning took 8,000 fur seals and 2,000 hair seals (Allen, 1899).
(*d*) 1825. Capt. Morrell took a few fur seals from Albemarle (Allen, 1899).
(*e*) 1872. Capt. Reed took 3,000 fur seals and about as many more during three subsequent voyages between 1872 and 1880 (Allen, 1899).

(*f*) 1872. Hassler Expedition. Specimens of *A. australis* collected (Allen, 1880).
(*g*) 1885. Capt. Gaffney took 1,000 fur seals (Allen, 1899).
(*h*) 1898–99. Capt. Noyes—seals not very numerous, took 224 skins (Allen, 1899). Heller collected type of *A. galapagoensis* on this voyage (Heller, 1904).
(*i*) 1923. Beebe saw only two fur seals (Beebe, 1924)
(*j*) 1931. Sea-lions and seals numerous and quite tame (Korwin, 1931).
(*k*) 1932–33. Capt. Hancock caught several fur seals which were presented to San Diego Zoo (Townsend, 1934).

As even the incomplete list above shows, there is quite a number of records of sealers taking fur seals from the islands off the South American coast from the Galapagos Islands southwards. The story of these fur seals is the usual one of uncontrolled exploitation. Millions of skins were taken until the middle of the nineteenth century when the numbers dropped rapidly and for about the last 40 years not only are there no records of any commercial sealing, but there are very few referring to seals at all, and even these indicate that there cannot be many fur seals on the islands.

It appears from the available records that the sealing expeditions worked northwards along the west coast of South America, as seals at Masafuera and Juan Fernandez were abundant until about 1798, at St. Mary's until 1816, while there were still considerable numbers at the Galapagos as late as 1885.

There is still some doubt as to the identity of these " fur seals." Townsend (in Allen, 1899) refers to the Galapagos seal as *A. philippi*, but does not give any reasons for his identification. The only other records where specific names are used are those of Allen (1880), Heller (1904), Nybelin (1931) and Townsend (1934) for seals on the Galapagos and Juan Fernandez and in all four instances *A. australis* is the animal named. Both *A. australis* and *A. philippi* have been reliably recorded from Juan Fernandez, and *A. australis* from the Galapagos, so it is not unlikely, though not proven, that *A. philippi* also occurs on the Galapagos. The bulk of the records of " fur seals " from these South American islands probably refer to *A. australis* although the scarcity of records makes it impossible to be certain. For the same reason it is not known what the present status of this seal is along the western South American coast.

Other Otariids frequent the shores and islands of the Pacific coast of America. Of these the best known is the Californian sea-lion *Zalophus californianus*. The most southerly point from which it has been recorded is the Galapagos Islands. Beebe (1924) went to these islands in 1923 and makes several references to the sea-lions that he saw there. He identifies them as " Southern sea-lion, *Otaria jubata*," but the photographs he gives show the short pointed nose of *Zalophus* and not the heavy upturned snout of *O. byronia*. Wollebaek (1927) went to these islands in 1925, and although he does not mention the seals by name he gives a photograph which is undoubtedly of a *Zalophus*. Skulls of *Zalophus* from the Galapagos which are in the U.S. National Museum are figured by Allen (1905) although he wrongly calls them *A. philippi*. *Zalophus* is well known on the islands off the Californian coast and probably extends northwards as far as the bay of San Francisco.

Steller's sea-lion, *Eumetopias jubatus*, is known to extend its range as far south as San Nicolas Island, although there are no records of it breeding any further south than Santa Rosa Island, 42 miles north of San Nicolas.

The Northern fur seal *Callorhinus ursinus*, although it breeds mainly on the Pribilof Islands, spends the winter and early spring at sea and may migrate southwards to the latitude of California, although it rarely comes ashore there.

The distribution of the Southern sea-lion, *Otaria byronia*, corresponds with that *of A. australis*. Both Heller (1904) and Allen (1880) note its presence on the Galapagos Islands and it is known on Juan Fernandez, round Cape Horn and along the eastern coast of South America as far as Lobos Island, Uruguay.

SUMMARY OF THE MAIN CHARACTERS AND DISTRIBUTION OF THE OTARIIDS OF THE PACIFIC COAST OF AMERICA

Otaria byronia Blainville, 1820. Southern sea-lion.

SIZE. Length of adult male from nose to end of tail 6–7 ft., and of female 5–6 ft. Weight of adult male over 1,500 lb.

DESCRIPTION. Males and females similar in colour, back usually dark brown, mane of male and neck of female, and the belly dark yellow. Face dark and hair of flippers reddish. Bare parts of skin black. Whiskers long, reaching 12 in. in adult male, about 30 on each side, straw coloured and forming a pale moustache. Variations in colour frequent, and many paler animals found. Newly-born pups practically black, soon fading to chocolate, and after first moult at a few months old, a dark grey.

Male with extremely thick and heavy neck thrown into folds, this together with the lighter and thicker hair on the neck gives the appearance of a mane. Female slighter in build. Head short and muzzle deep and upturned.

DISTRIBUTION. From Lobos Island, Uruquay to Straits of Magellan, Falkland Islands, Galapagos Islands.

SKULL. Condylo-basal length up to 358 mm. in adult males, and 267 mm. in adult females. Easily distinguishable from skulls of all other seals by the greatly elongated palate extending backwards as far as the pterygoids, and becoming progressively more concave posteriorly. Adult male skull with well-developed sagittal and parietal crests, and various processes on the parietal for the attachment of muscles.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{6}{5}$.

Eumetopias jubatus (Schreber 1776). Steller's sea-lion.

SIZE. Length of adult male from nose to end of tail 11–13 ft. and of adult female 8–9 ft. Weight of adult male 1,000–1,200 lb., of adult female 400–500 lb.

DESCRIPTION. Both males and females a light reddish brown ; slightly darker on the belly. Colour varying with age and season and coat lighter when just moulted. Naked parts of skin black. Whiskers long and slender, the longest about 20 in., white or brownish white. Adult males with mane on neck. The largest of the eared

seals. Has a rather bear-like head with a short straight nose, not upturned as in *O. byronia*. Muzzle and neck very heavy.

DISTRIBUTION. Shores of the north Pacific from Behring Straits southward to Santa Barbara Islands, California, and Japan.

SKULL. Condylo-basal length up to 380 mm. in adult males. Skull distinguished by the anteriorly placed quadrate supraorbital processes and, in all except young skulls, a large gap between the upper 4th and 5th molars. Palate with hinder end contracted and truncate.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{5}{5}$.

Arctocephalus philippi (Peters 1866). "Juan Fernandez" fur seal.

SIZE. Length of adult male from nose to end of tail *ca.* 5 ft. Adult female probably slightly smaller.

DESCRIPTION. Above blackish grey, more yellowish grey on head and neck; brownish black below, proximal part of limbs, lips and chin rusty brown. Overhair rusty brown with black tips, thick underfur rust red. Whiskers in six rows, some black, some white, and some white with black tips. Animal distinguished by slender tapering snout.

DISTRIBUTION. Juan Fernandez, Guadalupe, Santa Barbara Islands, Farallone Islands.

SKULL: 1. Skull narrow, the mastoid breadth being 48–50% of condylo-basal length.
2. Palate narrow and very deep in front.
3. Maxillary root of zygoma very wide.
4. Flat tympanic bullae.
5. Narrow zygomatic arch.
6. Snout narrow.
7. Posterior prolongations of palatines not thickened.
8. Teeth usually without accessory cusps and widely spaced.

Measurements of few authentic specimens known but condylo-basal length of adult male skull *ca.* 256 mm.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{6}{5}$. (Peters' type skull has only $m.\frac{5}{5}$ but number of molar teeth of *Arctocephalus* rather variable).

Arctocephalus australis (Zimmermann 1783). Southern fur seal.

SIZE. Length of adult male from nose to end of tail 5 ft. 6 in., and of adult female 4 ft.

DESCRIPTION. Overhair black, tipped with grey except on belly where blackish brown. Hairs 1–2 in. long on back of neck but shorter over rest of body. Underfur reddish brown. Dorsal surface of manus and pes covered up to nails with black hairs. Tip of nose and naked skin of limbs black. Whiskers white, though some of the smaller are greyish black, about 20 on each side. Very few photographs

available, but appears to be rather like *Callorhinus* in the external shape of the head, except that the nose is rather longer and slightly upturned.

DISTRIBUTION. Shores and islands of South America from Lobos Islands, Uruguay, to the Galapagos Islands, Straits of Magellan, Falkland Islands, S. Georgia.

SKULL. Condylo-basal length up to about 250 mm. in adult male. Skull squarish in general shape, heavily built, with thick zygomatic arches and short broad nasals.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{6}{5}$.

Callorhinus ursinus (L.). Northern fur seal.

SIZE. Length of adult male from nose to the end of tail 7–8 ft. and of adult female 4ft. Weight of adult male 500–600 lb., of adult female 80–100 lb.

DESCRIPTION. Males nearly black on the back and brownish ventrally, neck and shoulders greyish. Limbs reddish brown. Naked areas of skin black. Females lighter than males. being grey dorsally, but otherwise like males. Whiskers white, or with brownish tips. Black in young animals. Distinguished externally by the high forehead and extremely short pointed nose.

DISTRIBUTION. From Pribilof Islands south to California and Japan.

SKULL. Condylo-basal length up to *ca.* 250 mm. in adult males. Interorbital region long, facial region very short and high, descending abruptly. Dentition weak.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{6}{5}$.

Zalophus californianus (Lesson 1828). Californian sea-lion.

SIZE. Length of adult male from nose to end of tail 8 ft., and of adult female 6 ft. Weight of adult male 500–600 lb.

DESCRIPTION. Not so heavily built as *Otaria* or *Eumetopias* with not such a thick neck in adult males.

DISTRIBUTION. Galapagos (but see Sivertsen's (1953) account of *Z. wollebaeki*), shores and islands of California north to Farallone Islands.

SKULL. Condylo-basal length up to 320 mm. in adult males. Skull of adult males easily distinguishable by the very high sagittal crest. Skulls of females and young males slender with elongated nasals and facial regions.

DENTITION. $i.\frac{3}{2}$ $c.\frac{1}{1}$ $m.\frac{6}{5}$.

KEY FOR DISTINGUISHING SKULLS OF PACIFIC AMERICAN OTARIIDAE

1. Skull with supraorbital processes and alisphenoid canal . . . . . *Otariidae*
   2. Posterior end of floor of palate very concave and extending backwards as far as the pterygoids . . . . . *O. byronia*
   2*a*. Posterior end of floor of palate not extending backwards as far as the pterygoids 3.
      3. Supraorbital processes quadrate. Molars 5/5 with large gap between upper m. 4 and m. 5 in adult skulls . . . . . *E. jubatus*

3*a*. Supraorbital processes triangular. Molars 6/5 with no large gap between upper m. 4 and m. 5 in adult skulls . . . . . 4.
4. Nasals long and slender, combined widths at anterior ends *ca.* 40–50% of length 5.
4*a*. Nasals short and broad, combined widths at anterior ends *ca.* 80–90% of length 6.
5. Palate very narrow, the internal distance between m. 1–3 being the same. Floor of palate very concave between these molars. Tympanic bullae smooth and rounded. No very high sagittal crest in old males . *A. philippi*
5*a*. Palate wider, the distance between the molars increasing gradually. Floor of palate only very slightly concave. Surface of tympanic bullae irregular. Very high sagittal crest in old males . . . *Z. californianus*
6. Interorbital region long in adult animals, *ca.* 20% of condylo-basal length. Snout, at level of m. 2, practically as high as it is long . . . *C. ursinus*
6*a*. Interorbital region less than 20% of condylo-basal length in adult animals. Snout much longer than it is high . . . . . *A. australis*
1*a*. Skull without supraorbital processes or alisphenoid canal (not considered in this key) *Phocidae*

Note: The above characters apply mainly to adult skulls.

SUMMARY

After comparison with skulls of fur seals known to occur along the Pacific coast of America, the type skull of *Arctocephalus galapagoensis*, which was collected on Wenman Island in the Galapagos group in 1898–99, is shown to be similar to skulls of *A. australis*.

Skulls of fur seals brought back from the Galapagos Islands in 1932–33 are also identified as *A. australis*.

A statistical treatment of proportions of skull measurements of *A. australis* from the Falkland Islands on the one hand, and the mainland of South America and the Galapagos Islands on the other, makes it seem probable that the Falkland Islands animals belong to a larger race. The shortage of specimens makes it impossible at the moment to distinguish the Galapagos skulls from those of other mainland populations.

It is shown by a comparison of skull drawings, measurements and proportions that the Guadalupe fur seal *A. townsendi* is the same as the Juan Fernandez fur seal *A. philippi*. A chronological list is given of the recorded occurrences of this seal and it is suggested that its normal habitat is the islands off the coast of California. The few records from Juan Fernandez represent animals taken at the most southerly point of the range, but its abundance there was probably masked by the greater numbers of *A. australis*.

A list is given of records of un-named "fur seals" from the Galapagos Islands southwards. It is probable that most of these records refer to *A. australis*.

A brief account is given of the distribution of *Z. californianus*, *E. jubatus*, *C. ursinus* and *O. byronia*, the other Otariids which occur along the coast.

A summary is given of all the Otariids occurring along the Pacific coast of America, and also a key for distinguishing their skulls.

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NOTES ON THE MEASUREMENTS USED

1. Greatest length—from the posterior surface of the occipital condyles to the anterior surface of the knob formed by the premaxillae, above the incisors.

2. Condylo-basal length—from the posterior surface of the occipital condyles to the anterior surface of the premaxillae at the level of the incisors.

3. Snout length—from the most anterior part of the edge of the orbit to the anterior surface of the premaxillae at the level of the incisors.

4. Antero-posterior width of the zygomatic root of the maxilla—between the inferior lip of the antorbital foramen and the orbit.

5. Gnathion—is defined by Thomas (1905) as the most anterior point of the premaxillae, on or near the mid line. In *Arctocephalus* the most anterior point of the premaxillae is a projecting knob of very variable size, so the gnathion is taken here as the most anterior surface of the premaxillae at the level of the incisors, and does not include the knob.

6. Basion—as defined by Thomas (1905), a point in the middle line of the hinder edge of the basioccipital margin of the foramen magnum.

7. Henselion—as defined by Thomas (1905), the back of the aveolus of either of the median incisors.

8. Palation—as defined by Thomas (1905), the most anterior point of the hinder edge of the bony palate, whether in the middle line or on either side of a median spine.

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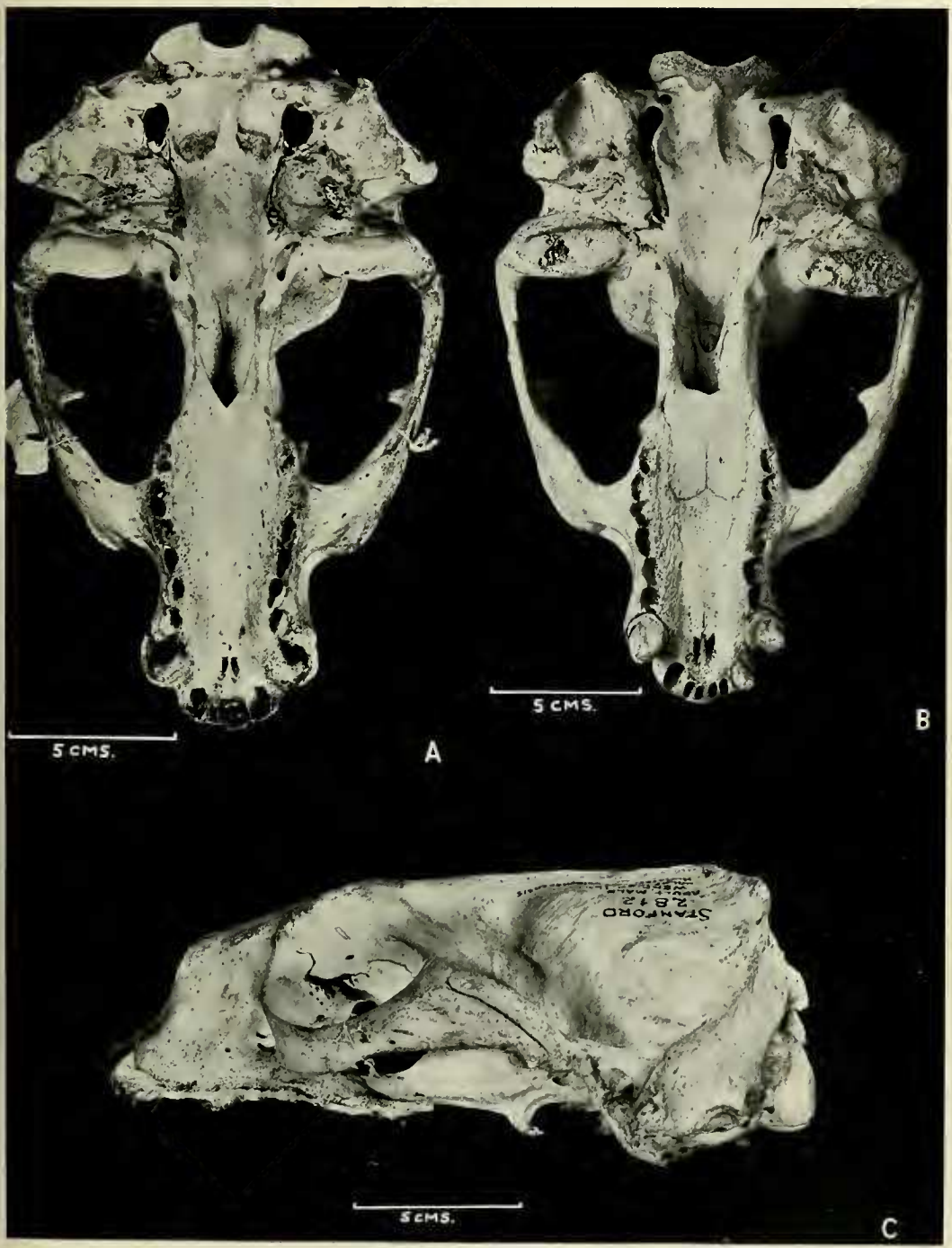
PLATE 10

A. Ventral view of type skull of *Arctocephalus galapagoensis*, No. 2812, Stanford University, California. (Photograph by Dr. Antenor L. de Carvalho.) B. Ventral view of skull of *A. australis*, 1880.7.28.7, B.M.(N.H.). C. Lateral view of type skull of *A. galapagoensis*, No. 2812.


5 CMS.
A
5 CMS.
B
STANFORD
2812
5 CMS.
C

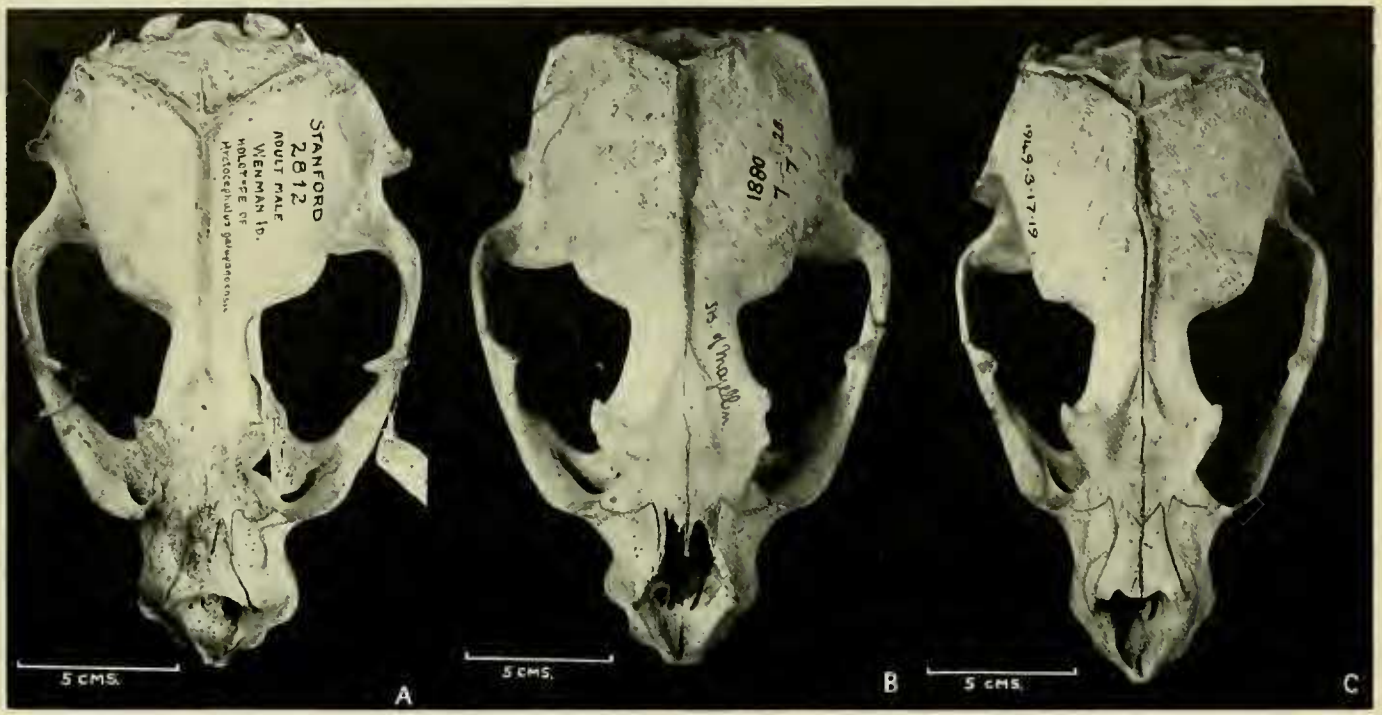

STANFORD
2812
ADULT MALE
WENMAN Id.
HOLOTYPE OF
Microcephalus stanfordensis
5 CMS.
A
1880
5 CMS.
B
1924.9.3.17-19
5 CMS.
C

PLATE 11

Dorsal views of: A. Type skull of *A. galapagoensis*, No. 2812. B. Skull of *A. australis*, 1880.7.28.7, B.M.(N.H.). C. Skull of *A. australis*, 1949.3.17.19, B.M.(N.H.). B and C are skulls of *A. australis* of the same condylo-basal length from the Straits of Magellan and the Falkland Islands respectively.